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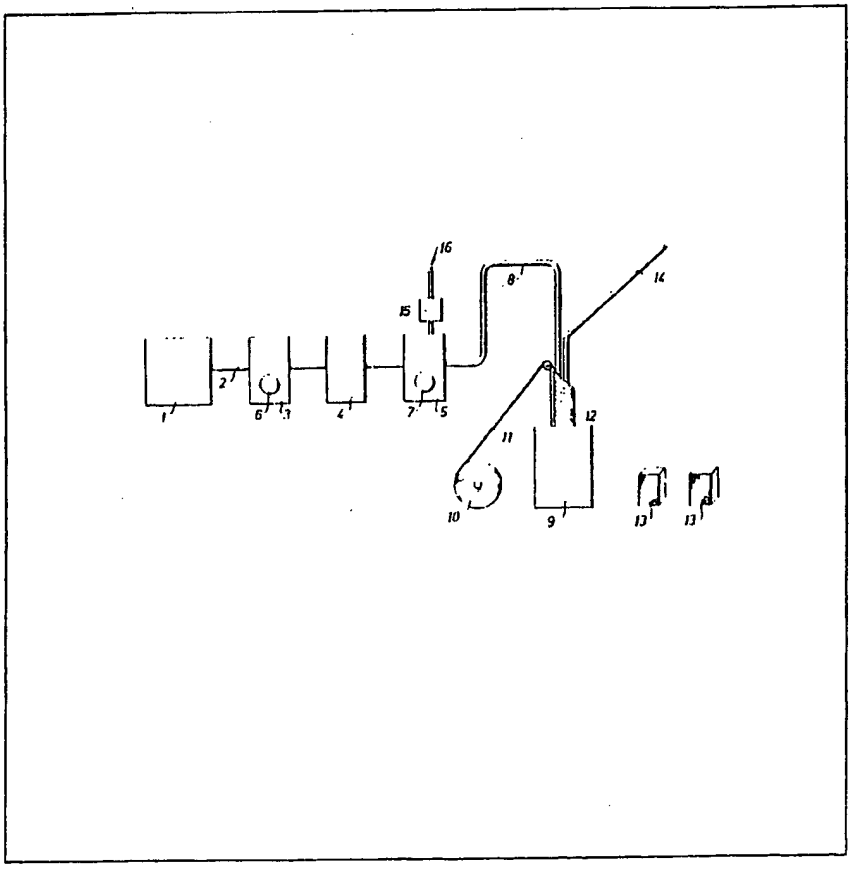
(54) **Packaged fish product**

(57) In a method for the production of a food product a raw material consisting of a marine organism such as Krill or mixture of such organisms, is treated by breaking down the marine organism into small particles, sterilizing and then cooling these particles to form a sterilized coagulated product, grinding the sterilized coagulated product into liquid or semi-liquid form and packaging the sterilized product in aseptic packages. The sterilized product may be solidified in the packages by the addition of suitable coagulants. In an alternative method, the particulate marine organisms are heated to promote sterilization and coagulation, after packaging.



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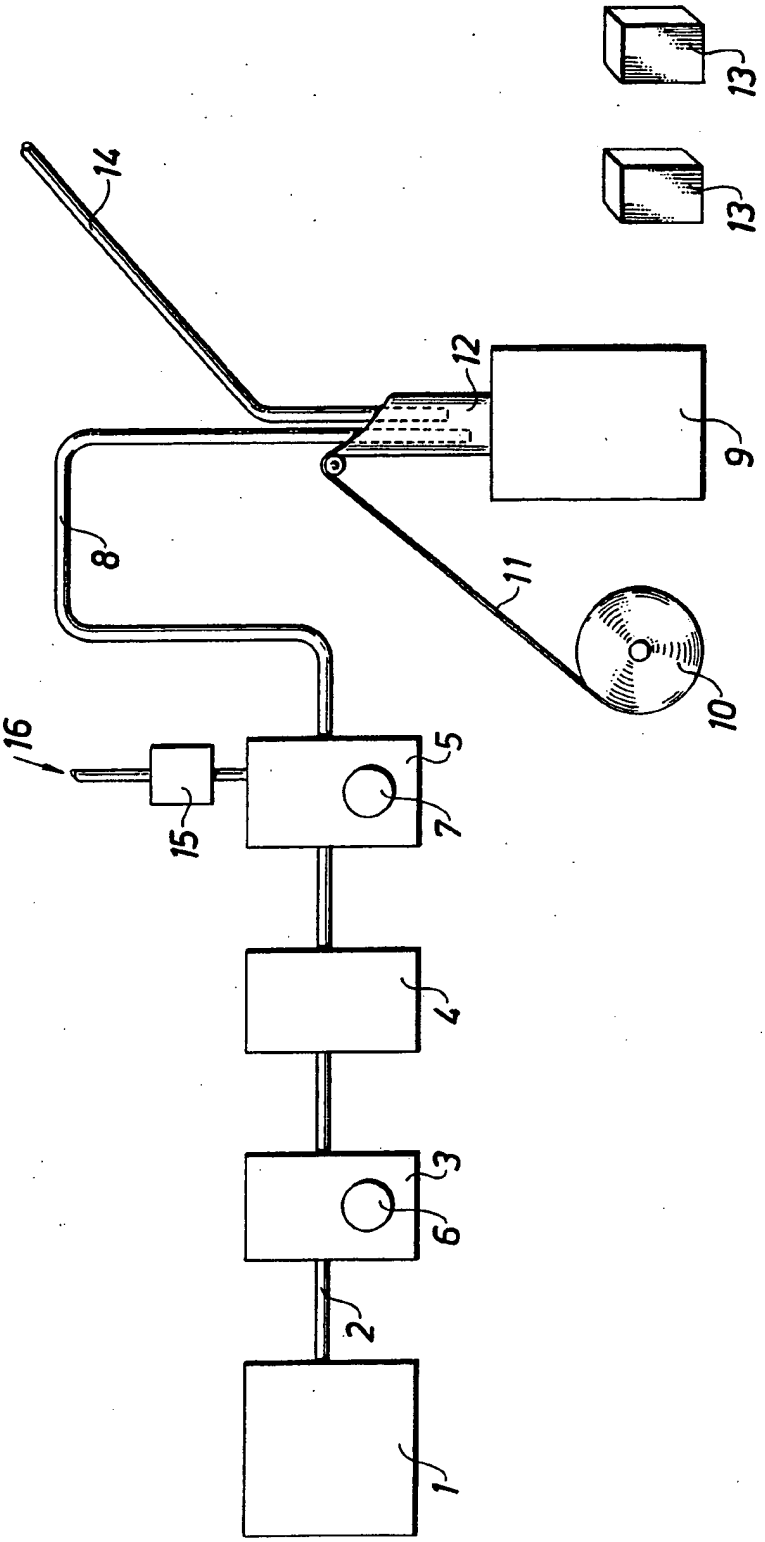
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SPECIFICATION

Improvements in and relating to the preparation and packaging of a sea food

This invention relates to the preparation and packaging of a sea food and more especially to a method for treating and packaging of a sea food product for the purpose of ensuring good keeping properties for the product, and also to a sea food product treated in accordance with the said method.

A large part of the fish caught at present is hauled in by fishing vessels which operate far out in the ocean and which collaborate with parent ships equipped with machines and apparatus for cleaning, filleting and deep-freezing the fish, and for the production of tinned-fish products. However, a large part of the fish thus caught is lost as fish-cleaning waste, and a considerable part of the catch is not utilized at all, or is used for manufacturing animal fodder in the form of fish meal. Large quantities of so-called Krill (euphausiacea) which is a prawn or shrimp species of the family Crustacea, are present in the ocean, and especially in arctic waters, in very large shoals, and are hauled in with other catches. Krill is very rich in protein and a great part of the shortage of protein food which exists in the world could be remedied if the protein from Krill and fish could be made use of in a suitable manner. In addition to Krill there is a potential catch of large quantities of mussels, cuttlefish and plankton which at present is not utilized and it should be understood that all such sea foods are included when reference is made to Krill herein. As mentioned above, it is known that fish or Krill can be converted to fish meal which is very rich in protein, but it has been difficult to use this fish meal for human food-stuffs, since among other things the taste is not sufficiently pleasing, and the bulk of the fish meal is used for animal fodder instead.

Thus there appears to be a great need for utilizing sea foods such as Krill and fish waste which is not directly consumable, for the preparation of an inexpensive food for human beings containing protein, which has good keeping properties and an acceptable taste. Such a food should be prepared, sterilized and packaged in bacteria-proof packages in order to ensure the keeping properties necessary for distributing such food, e.g. to the developing countries where great shortage of high-protein food exists, but where there are few or no ready facilities for distributing and storing the food in cooled or frozen condition. It is known in packaging technology that sterilized milk can be packed by automatic packaging machines under aseptic conditions in bacteria-proof packages made of a packaging material consisting of plastic-covered paper. These packages are very cheap and light, which means that the transport costs remain low. The product to be packaged by such an automatic packaging machine must be mainly liquid or semi-liquid, although it may contain small amounts of solid content, and therefore it is necessary to process the product in such a way that it will be liquid or semi-liquid before the packaging operation. Another problem is that the packaged product should preferably be substantially solidified in the package and this solidification should be "thermostable", i.e. the product taken from the package should not melt or otherwise be liquified when subjected to heat.

By using these known methods for the aseptic packaging of sterilized foodstuffs, many of the products which now go to waste, or which are used in an irrational manner, can be utilized for nourishment, in accordance with the method of the invention. A preferred procedure in accordance with the invention may be characterized in that

(a) the raw material required for the foodstuff being packaged is treated by mechanical and/or chemical means, to be broken down to particles of average size smaller than 5 mm and preferably smaller than 1 mm, to form a substantially homogeneous fluid or semi-fluid condition:

(b) the said raw product is heated before, during and/or after the breaking-down proces, to such an extent that the product becomes sterile, and the proteins of the product are, at least partly, caused to coagulate;

(c) the product, being at least partly coagulated, is cooled to a temperature below the coagulating temperature, and is processed and homogenized to break it down again under aseptic conditions to a substantially fluid or semi-fluid form;

(d) the sterilized product is packaged under aseptic conditions into bacteria-proof packages wherein the product is caused to stiffen to semi-solid form by coagulating agents or water-absorbing organic compounds contained in the product, or specifically added to it.

The invention will now be described in greater detail with reference to the accompanying schematic drawing which shows a diagram of the process in accordance with the invention.

In the said diagram is shown a collecting or mixing tank 1, apparatus 3 for fine disintegration (grinding) and homogenization of the raw material and a pipeline 2 between the mixing or collecting tank 1 and the homogenizing apparatus 3. A heat sterilizer, 4 communicates with a second homogenizing and grinding device 5 connected to a packaging machine 9. The homogenizing devices 3 and 5 in the case illustrated, are provided with mechanical finely disintegrating mills 6 and 7 respectively, and the packaging machine 9 has a magazine roll 10 of packaging material, from which a web 11 is drawn off and formed into a tube 12, which is sterilized and thereafter filled with contents from the filler pipes 8 and 14 respectively, and is sealed shaped and severed to form closed bacteria-tight packaging containers 13.

It is the intention that the process equipment shown in the diagram shall be installed aboard the parent ocean-going vessels mentioned earlier, which follow and serve a large number of fishing boats, the raw products which are to be treated being delivered continuously to the mixing tank 1. Alternatively the Krill or fish caught abroad the fishing boats may be frozen and transported ashore where the processing and packaging facilities may be located. The raw products may consist, for

example of Krill, caught in large quantities, but alternatively the raw product may be whole prawns or parts thereof, or, cleaned or uncleaned fish which for one reason or another has not been used for deep-freezing or tinning, or fish-cleaning waste, especially from lean, filleted fish, cuttlefish, mussels etc. It is also possible to use as the raw product some species of plankton and other unicellular organisms, and also edible algae, with, if desired, green vegetables and, in order to give a suitable taste to the product, there may be added brine and spices of different kinds, e.g. saffron. In general the process described is intended to treat Krill as the most important raw material, and one essential advantage with the Krill as raw material is that the whole of the fish can be utilized, which makes it unnecessary to rinse or peel it. The shell and the skeleton of the Krill can be ground to colloidal form and the eyes of the Krill contain a red colouring substance, which gives the product a nice, pink colour.

From the mixing tank 1 the raw product, consisting in the case being described mainly of Krill together with some salted water, is transferred through a relatively thick pipe 2 to a homogenizing chamber 3, wherein the raw products are mechanically processed and broken down to smaller pieces which do not exceed 5 mm in size, and are preferably not more than 1 mm in size. It is preferred in some cases to grind the Krill into colloidal form (less than 100Å). In certain cases it is appropriate, in addition to the mechanical processing, to break the material down by chemical (enzymatic) means, and in this case a suitable enzyme is added in the mixing tank. In the homogenizing chamber 3 the product is converted to a fluid or a semi-fluid mass which can be conditioned in different ways. To improve the sterilization there may for example, be added and acid substance if the pH value of the mixture is too high. The acid substance is added to such an extent that the pH value of the mixture is lowered to 7 or less. In the event of the pH value of the mixture being too low, the mixture is conditioned by adding a basic substance. It is also appropriate immediately prior to the heat treatment of the homogenized mass to add a water-absorbing carbohydrate, e.g. coarsely ground rice. The carboydrate is added at this late stage in the process so that it cannot absorb liquid to its full capacity before the actual packaging.

The raw product thus homogenized and conditioned is introduced into the sterilizer 4, wherein the fluid or semi-fluid product is heated to a temperature exceeding 120°C, and preferably 140°C, for at least 4-8 seconds, and in some apparatus up to 30-50 seconds. To achieve full sterility it is important that all parts of the product are heated to a sufficiently high temperature for a sufficiently long period, which means that the length of the treatment should be adapted to the size of the individual particles in the fluid or semi-fluid product, and therefor the time for the treatment may be varied between 4 and 60 seconds.

During the heat treatment, in addition to sterilization of the product, a coagulation of the proteins present in the product also takes place, causing the product to become, wholly or partly, of a more solid consistency after the heat treatment.

As it is desired that the product shall be fluid or semi-fluid for the packaging operation, the sterilized product is passed to another homogenizer, wherein the , under aseptic conditions, is again subjected to a mechanical homogenization treatment so that it again becomes fluid or semi-fluid, and the particles ground to colloidal size. The product is thereupon passed through he pipeline 8 to the packaging machine. If the product, before the sterilization operation, has been conditioned by addition of an acid substance to lower the pH value of the product, the pH value may, before the actual packaging, be increased again by the addition of a basic substance which can promote the coagulation of the product after packaging. In the packaging machine a web of plastics-covered paper, which is unrolled from a magaxine roll 10, is converted to a tube by bonding together the longitudinal edges of the web by welding together the plastics surface layers of the edge regions, brought face to face with one another, by heat and pressure. The tube 12 so formed is sterilized internally e.g. by applying a chemical sterilizing agent, such as hydrogen peroxide, to the web 11 in advance, the agent being then heated and vaporized by heating the inner walls of the tube 12 e.g. by a radiation element introduced inside the tube. By the combined effect of heat and hydrogen peroxide all bacteria on the packaging material surface forming the inside of the tube 12 are killed, whereupon the sterilized product, which is introduced through the pipe 8, is loaded into the tube, which is then sealed by pressure and heat along successively spaced narrow seals extending transversely of the longitudinal axis of the tube so that the sterilized product is enclosed in sterilized packages in a bacteria-proof manner. Each tube enclosure separated by the transverse seals can then be severed from the rest of the tube by cutting through the sealing zone, and if desired the said severed tube portions can be shaped to form, for example, parallellepipedic or tetrahedral packaging containers 13. If it is desired for the packed product to contain larger pieces of the foodstuff e.g. fish, such pieces may be sterilized separately and then added to the tube 13 in portions through the separate filler pipe 14, and be dispensed so that a suitable quantity of fish pieces is located in each package.

The containers 13 now contain fluid or semi-fluid product which, however, during the storage period is caused to stiffen and to assume a semi-solid or solid consistency, a certain gas content in the semi-fluid product bringing about a prearranged bubble formation in the solid product. The change in consistency may occur owing to the liquid-absorbing organic compounds, e.g. coarsely ground rice, which take up moisture with simultaneous swelling, and at the same time the protein of the product coagulates again. For a further increase of the solidity of the packaged product suitable coagulating substances, e.g. gelatine, may be added, which however, if they are added after the sterilizing operation must be pre-sterilized separately to avoid the contents of the packages becoming infected.

The packages 13 now contain a high-protein

product, with an agreeable taste thanks to the seasoning, which may be kept for a number of months, during which time the product owing to the effect of the abovementioned coagulating agents and carboydrates stiffens in its package to form a solid or semi-solid mass. The time it takes for the semi-fluid product to stiffen in the package depends on a number of factors, e.g. the natural coagulation of the product, the quantity of liquid-absorbing carbohydrates etc. but as an approximate time interval a period of 2 hours to 3 days may be quoted. Thus it is possible to keep and transport the sterilized and aseptically packaged product in its package, without need for any special cooling, which means that the product, which is cheap and very rich in protein, can be used in developing countries a long time after the actual packaging, while the preparation and packaging of the product can take place immediately as the raw product becomes available. The raw product mentioned earlier, which may consist, for example, of Krill, does not, as mentioned above, have to be prepared in fresh condition immediately after the catch, but it is quite satisfactory for the raw product to be heat-treated separately or deep-frozen, for later utilization according to the invention.

It is to be noted that the most important characteristics of the sterile food product produced and packaged are

(a) the taste
(b) the colour,
(c) the consistency and structure, and
(d) the preparing ability (e.g. the heat resistance).

(a) The taste can be varied and improved within relatively wide limits, by addition of spices and other flavouring substances. If, however, the raw material used has a "basic" dominant taste, e.g. bitterness, it will be difficult to remove such a dominant taste. The Krill has however no such dominant taste and therefore it is normally easy to provide a desired flavour in a food product based upon Krill. It is to be noted that the whole Krill, including shell, head, etc., can be used without difficulties regarding the taste of the food product prepared.

(b) The colour of a food product of the kind described is important, and it is known that fish products of different kinds are mostly white or at least very "pale". Other kinds of raw material like normal prawns or shrimp will give a brownish product, which may be considered to be too dark.

The colour of the food product can be improved by artificial colouring, but as artificial colouring of foodstuffs is prohibited in some countries and under discussion in other countries, it is preferable for the use of artificial colouring to be avoided.

The Krill prepared in accordance with the invention naturally provides a product of a pleasant pink colour which emanates from a natural colour substance in the eyes of the Krill. The colour of the product when based upon the "whole Krill" is consequently better than the product based upon the tails of the Krill only, as the pink colour mainly emanates from the eyes.

(c) The consistency and structure of the product is very important and as mentioned above one of the problems solved by the invention is that the product should be in liquid form during the packaging operation, but become solidified for use. The consistency should be such that the "form stability" of the product is maintained when the product is removed from the package and no longer supported by the walls of the container. In other words, the product should coagulate in the package after the packaging process. This coagulation is at least partly a natural process, as the proteins in the finely ground product have a natural tendency to adhere to one another (coagulate) when the product, after packaging, is coming to rest in the container. This coagulation process can be accelerated and amplified by additives, such as gelatine, or hygroscopic materials, such as rice meal or other water-absorbing carbohydrates. The Krill contains a sufficient amount of proteins for coagulating the product in such a way that the product will be solidified without additives of the kind mentioned, but such additives might be added in order to improve the consistency.

The structure or texture of the product can be improved by introducing small gas bubbles in the liquid or semi-liquid product which gas bubbles give the solidified product a quenelle-like "flushy" structure. Such gas bubbles may be formed in the product if the product emits gas during the solidification process, but a better method to obtain the "gas bubble structure" desired is to add a gas (sterilized gas) to the homogenizer and grinding means 7 through the pipe 15, which contains a sterile filter, In the homogenizer 7 the gas introduced is thoroughly mixed with the product, which is liquified in the homogenizer. The gas is dispersed in the product as small bubbles and may partly be dissolved in the water which is set free when the Krill is ground into colloidal particles. When the liquid or semi-liquid product is packaged the gas bubbles are trapped in the product when this is solidified and the quenelle-like structure is obtained. It is possible to use air as the gas for mixing with the product; alternatively other gases, such as nitrogen or carbondioxide, may be used.

(d) The "preparing ability" is partly linked with the other characteristics mentioned above as the colour, taste etc. and should be such as not to deteriorate when the product is cooked, fried or prepared for consumption in any other way.

One important characteristic in this respect is the so-called "thermostability" or "heat resistance". It is pointed out that it is important for the consistency of the product to be stable which means that the product should be capable of being heated without melting. In other words, the "Krill" should not melt or flow out in the frying pan when being cooked. If the solidification of the product is based solely on gelatine or similar additives the product will undoubtedly melt when subjected to heat, while a natural coagulation of the proteins, and even a solidification by water-absorbants, provides a heat-stable product which can be cooked e.g. fried without melting, and, as mentioned above, the finely ground Krill has a sufficient content of proteins for coagulation.

Consequently, the Krill is a raw material which

fulfills all the requirements mentioned above, and as the Krill can easily be caught in large quantities, and need not necessarily be rinsed or peeled in any way, it is easy to understand that it is a valuable, and cheap raw material for the product in accordance with the invention. It is cheap, nutritious, acceptable as regards taste, consistency, structure and colour, and can be made widely available since the packages are aseptic so that the product will keep fresh for months in an unopened package without any cooled storage.

It is within the scope of the invention to modify the method of treatment described above in such a way, that the packages which are filled and closed, are heated, together with their contents, after th packaging procedure. Such a "post packaging" heat treatment may be a complete sterilization treatment (which means that the "pre-packaging" heat treatment is superfluous), but it is also possible to restrict this later heat treatment to a mere stimulus for the coagulation process.

It was mentioned in the preamble that the Krill caught can be frozen and delivered to factories for performing the process in acordance with the invention, and it is of course also possible to have the "Krill patty" prepared in accordance with the invention in frozen blocks, packed in a conventional way and stored and distributed as a deep-frozen product; but some of the advantages will be lost if the Krill is prepared and distributed in such a way.

It is to be noted that the dry solid contents in the raw material used (preferably Krill) and the product as packaged and ready for consumption, is substantially the same, or about 25%. As the amount of additives is negligible it can be claimed that the product packaged is natural Krill in a reshaped and edible mode.

CLAIMS

1. A method of preparing a foodstuff for human consumption wherein a mass of marine organisms such as Krill is reduced to particles of small size in a substantially homogenized fluid or semi-fluid condition, and packed into a sealed enclosure, the material being sterilized, and coagulation promoted, by heating either before or after packaging.

2. A method as claimed in Claim 1 wherein the fluid or semi-fluid mass is sterilized and coagulation promoted by heating before being packaged, and thereafter again disintegrated to a fluent condition to facilitate packaging.

3. A method as claimed in Claim 1 or 2 wherein to the said mass is/are added flavouring materials and/or salt.

4. A method as claimed in Claim 1, 2 or 3 wherein the raw material is reduced to particles of small size or disintegrated by grinding.

5. A method as claimed in any of Claims 1 - 4 wherein the mass is reduced to particles of average transverse size not greater than 5 mm, and preferably not more than 1 mm.

6. A method as claimed in any preceding claim wherein the mass is reduced to colloidal condition.

7. A method as claimed in Claim 6 wherein the reduction to colloidal form is assisted by chemical means, e.g. by adding an enzyme.

8. A method as claimed in Claim 2, or in any of Claims 3-7 when appendant to Claim 2 wherein immediately prior to the heat treatment a water-absorbing material e.g. a carbohydrate is added to the mass.

9. A method as claimed in Claim 2, or in any of Claims 3-8 when appendant to Claim 2, wherein the mass is packed into and sealed in containers under aseptic conditions.

10. A method as claimed in any preceding claim, wherein the mass is packed into, and sealed into, containers, and thereafter subjected with the containers to heat teatment for sterilization and/or to encourage coagulation of the contents.

11. A method for the treating and packaging of a food product for the purpose of obtaining good keeping properties of the product, characterized in that

(a) the raw product required for the foodstuff product is treted by mechanical and/or chemical means and broken down to particles, whose size is smaller than 5 mm and preferably smaller than 1 mm, so as to form a substantially homogeneous fluid or semi-fluid product,

(b) the said raw product is heated before, during or after the breaking-down process to such an extent that the product becomes sterile and that the proteins of the product are at least partly made to coagulate,

(c) the product which is at least partly coagulated is cooled to a temperature below the coagulating temperature, and is processed and homogenized and broken down again under aseptic conditions, to fluid or semi-fluid form, and

(d) the sterilized product is packed under aseptic conditions into bacteria-proof packages, wherein the product is made to stiffen to semi-solid or solid form by means of coagulating agents or water-absorbing organic compounds contained in the product or specially added to it.

12. A method as claimed in Claim 1, characterized in that the product is heated in connection with the sterilization to a temperature exceeding 120°C, preferably 140°C, during at least 4-8 seconds.

13. A method as claimed in Claim 11 or 12, characterized in that to the broken-down and homogenized product prior to the sterilizing heat treatment an acid or a basic substance is added, by means of which the ph value of the product is controlled.

14. A method as claimed in Claim 11, 12 or 13, characterized in that a water-absorbing carbohydrate, e.g rice, is added to the product prior to the sterilizing heat treatment.

15. A food product as claimed in any preceding claim, characterized in that the raw product is selected from one or more of the following products:
Krill (euphausiacea),
Whole prawns or shrimp or parts thereof,
Cleaned or uncleaned fish,
Fish-cleaning waste, especially from lean filleted fish.

17. A food product in accordance with Claim 16,

comprising larger pieces of protein and/or carbohydrate-rich products such for example as the flesh of the fish.

18. A method as claimed in Claim 11, characterized in that the chemical treatment of the raw product is biochemical (enzymatic).

19. A method as claimed in Claim 11, characterized in that the raw product is ground to colloidal particle sizes.

20. A food product as claimed in Claim 15, characterized in that the raw product is whole Krill.

21. A method of producing a food product substantially as described herein with reference to the accompanying drawing.

22. A food product substantially as described herein with reference to the accompanying drawing.

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